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# SIGMA XI QUARTERLY

VOL. 23 JUNE, 1935 NO. 2

## SEMI-CENTENNIAL, ITHACA, JUNE, 1936


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# SIGMA XI QUARTERLY

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## THE SEMI-CENTENNIAL

**The celebration of the fiftieth anniversary of the birth of our great society will take place in Ithaca, New York, June 19 and 20, 1936. A worthy program for this important event has been definitely fixed. Prominent men in the educational and scientific world have been invited to participate and it is expected that the speakers will be announced in the next issue of our journal. Chapters are strongly urged to acquaint themselves with the details of the celebration and to begin at the first meeting of the next academic year making arrangements to be represented by a large delegation. It is especially important that chapters take up at once the consideration of candidates for the two semi-centennial research awards of $1,000 each, one in the field of the biological sciences and one in the field of the physical sciences. Immediately upon the opening of the University year, and monthly thereafter, the chapter representatives on the semi-centennial committee will receive communications from the central committee about chapter participation in the celebration and the progress of the preparations. The attention of all Sigma Xi members and associates is especially directed to the semi-centennial program as here given.**

## THE SOCIETY OF THE SIGMA XI SEMI-CENTENNIAL

**June 19 and 20, 1936**
**Ithaca, New York**

**1. History and Record.**

**A semi-centennial history and record of the society will be published in 1936 uniform with the Quarter Century Record and History issued in 1911. The volume will give the history of the society and of the chapters, a complete list of members and associates, with their last known address, their field of work, their professional specialty and their avocation or hobby. Preparation of the material for this publication is now in progress in the office of the National Secretary.**

**2. The Program of the Celebration.**

**Friday Afternoon, June 19**

**a. Greetings from Cornell University.**
**b. Response from the President of Sigma Xi.**
**c. A brief history of Sigma Xi.**
**d. Address: The Service of Sigma Xi in the Universities of the Future.**

**Friday Evening, June 19**

**a. The Semi-centennial Dinner.**
**b. Address: Scientific Research and the Social Order, Present and Future.**

**Saturday Morning, June 20**

**a. Unveiling the Semi-centennial Memorial Tablet.**
**b. Address: Accomplishments and the Future of the Physical Sciences.**
**c. Address: Accomplishments and the Future of the Biological Sciences.**

**3. The Semi-centennial awards for Research.**

**Awards will be made as an aid for research, and will be given to research workers under forty years of age. There will be**

two awards of $1,000 each. Chapters will present nominations before February, 1936, to a committee on award to be named by the president of the society.

## OUR NEW CHAPTERS

With this issue of the Quarterly the Society of the Sigma Xi welcomes two new chapters, the sixty-fifth and sixty-sixth, to its illustrious circle. The installation at Wesleyan University took place on April 25, and that at Smith College on May 1, with President Parker and Secretary Ellery acting as installation officers. The installation address at Wesleyan was given by President James Bryan Conant of Harvard University who spoke on "Science and the Humanities," and that at Smith was given by Professor Harold Clayton Urey, of Columbia University who chose as his topic, "Isotopes and Their Significance." Both installations were attended by delegations from thirteen Sigma Xi chapters and clubs at nearby institutions, and at Smith by representatives of Amherst and Mt. Holyoke Colleges. These two new chapters and their officers are listed with the others in this issue of the journal.

# INDUSTRY—A CATALYST TO SCIENCE

HARRY L. WELLS
Business Manager, Northwestern University

It is with a real sense of self-consciousness that I undertake to prepare an article to be published in the SIGMA XI QUARTERLY. A year each of high school chemistry, physics and botany and a year each of college geology and zoology scarcely stamps one as a scientist. Add to these very full majors in economics and psychology and it is easy to see that my interests were not arrested by the wiles of pure science—to which they were at least exposed. In retrospect I can trace the growth of interests which led me away from these fields of determinable facts into the more intangible and evasive fields of social and business organization. I confess at the outset a spirit of resentment toward a prevailing tendency to glorify the fields of exact science and engineering as planes of higher intellectual requirements than are demanded in the fields where the facts of science meet the compromising and temporizing reactions of human minds. It is this very glorification which has brought us to an abrupt halt and which has given birth to the alarm that scientific accomplishment is outrunning social adjustment. There has been a tendency to treat these less tangible fields as unworthy of the attention of the best research minds and methods. Consequently we now awaken to the realization that human beings with their desires and prejudices are the really important factor in all research.

It is well, therefore, for men and women trained in the fields of pure and applied science to pause and contemplate their achievements, and to center their thoughts on the end results of their activity as they affect human beings.

There is plausible excuse for the topic "Business—A Catalyst to Science." Several approaches to the assignment might well hold business within the definition of a catalyst. We might present business as that agent which accelerates the delivery of the products of creative and research minds to their ultimate user. Again we might treat it as the agent which breaks down the social obstacles which keep scientific discoveries from becoming useful goods. This article was not prompted, however, by an interest in those approaches. The scientific minds have been called to account for misdeeds at a moment when they were unaware of their wrongdoing. The public press and the public platform have resounded with alarm over the outstripping of social adjustment by scientific achievement. They have painted pictures of the power and destruction placed in the hands of people unable to sense their significance. Quite generally individuals are joining the Bishop of Ripon in his terse challenge—uttered lightly—that "science should declare a holiday"—hide its dangerous discoveries and wait for society to catch up. Anyone who has served business during the last few years cannot help but have reflected upon the tremendous over-production capacity existing at the moment and the far-reaching possibilities of new invention and discovery with their decreasing requirements for human labor. Pitkin warns us of the ever-diminishing field for our best minds while at the same time there are ever-increasing facilities for producing them. Truly a real cause for reflection.

If I sense the interests of scientists correctly they are concerned with the strange way business has of coming to abrupt stops and presenting completely new sets of conditions. A reaction—if you please—which breaks down the intermingled elements of the scientific achievement and leaves new phenomena to deal with. This is the situation existing at the moment and is ample justification for serious consideration on the part of scientists. Business the catalyst has broken apart the elements of social structure and now stands amidst a new association of relationships. These new relationships point unmistakably—in my mind—to the human being as the *sine qua non* of all research.

Historically the relationship of scientific effort and business has been most interesting. In the early stages it took the patient wooing of business to convince men of science that there were intricacies in the manufacturing, delivering and social acceptance of their discoveries which could be risked through business incentive alone. The hazards still exist, but the scientific world now recognizes business as its ally, and the immediate reaction of discovery and creation is to utilize the machinery established by business incentive to complete the job. Many of us recall how cautious the scientific world was in permitting business to become a partner in its experiments.

Next—business broke loose the technique of scientific research as developed in the fields of pure science and began applying it to its problems of production—and scientific management in factories became a reality. Every conceivable short cut and principle of physical science was brought into play to reduce costs—human beings were thrown into the mould and weighed in terms of machine accuracy and speed. We began to talk about applied science and scientific methods and these emerged as accepted and sound business principles.

Then—with the field opened to applied science and scientific methods—business began to lure scientific minds out of the universities and into industrial laboratories. Fundamental discoveries began to appear under commercial experimentation. Larger and better laboratories were built. The scientific minds began to filter into plant-operating problems, and wider and wider opportunities were opened for research training. Rare indeed were the cases where men with real scientific ability sought positions in industry in the early stages, but gradually such opportunities became so attractive and conducive to effective work that the ablest minds succumbed. Today, according to scientists' own records, the large percentage of effective scientific work is carried on under commercial stimulation.

Business finally became prolific and problems of product and manufacture were handled with amazing speed. So far they were dealing with tangible facts. Gradually, however, competition became a battle of laboratories and research departments, and the whole span of substitute products, displacements, new packaging, new types of outlets and social acceptance began to undermine the stability of production. Even the sacred precincts of patent control became the playground for trained minds until many hours of the industrial scientists' time were spent in attempts to break such control or produce substitute products. The surges of over-acceptance and under-acceptance in specific products and entire industries became an acute problem. Industry began to turn trained

minds toward problems of distribution and consumer acceptance—problems which in the early stages of large-scale production were not so difficult. They were faced with the strenuous competition of—advertised name control—secret processes—habit-forming advertising—trick merchandising aids. Every effort pointed to one goal—hold the consumer of your product and devise means for attracting the consumer of your competitor's products. The thread became commandingly obvious—hold consumer acceptance or your business will fail. So we came to the level of competition which gave birth to the ills now the object of most of the industrial and political thinking—cut-throat prices—bribery—inconsistent policies—downright dishonesty with clients. All of these elements were at work many years before the depression started and none of them can be laid at the door of scientific thinking. They represented business methods born of strenuous competition.

Out of this same competition to gain the control of the consumer came the wave of mergers—prompted mostly by the effort to reduce costs in order to meet competition, but partly due to the policy of buying up irritating competitors. Out of this merger experience there began to loom a distinct picture which exposed the extent to which scientific and engineering activity had carried us. I refer to the fact that business men came to realize that volume control was the determining factor in most of their problems and particularly in automatic machinery development. They found that the scientific and engineering professions were equal to almost any task of reproducing the work of human hands provided someone controlled sufficient volume to justify the expense involved in building the machinery. It was this realization that gave the Technocrats the right to break forth with their alarm about what was happening to the human being in our whole mechanical progress. It is perfectly apparent to me that at the present moment there is sufficient engineering and scientific skill and knowledge available to replace literally hundreds of thousands of workers and the determining factor is purely a question of concentrating sufficient volume to justify the expense necessary to produce the machinery to accomplish the task. Certainly there is no reason for pointing a finger of blame toward the scientists or engineers for the progress that they have made. We have simply reached a realization that the purpose for all scientific and engineering activity is the welfare of human beings. Equally clear is the realization that we have left this great field of human adjustment to scientific advancement too generally untouched by the application of high-grade minds to the problem.

It would be unfair to point out automatic machine development as the one contributing factor to our present dilemma because at the same time progress has been made in short-cutting middleman distribution and substituting products which in and of themselves require less human labor to manufacture. For the purpose of this discussion, however, we will confine our thinking to mechanical advancement where the greatest number of laborers are being replaced. It is very important for the scientific and engineering world to recognize at once that they have reached a stage where on the tasks existing at the moment tremendous strides can be made toward replacing human labor. Out of my

experience in business I am a little fearful that too few realize what rapid speed can be made if sufficient volume can be accumulated to justify the expense.

At this point in my argument the economist enters the picture and points to the fact that new industries and new products have always come forth to take up the slack created by the progress made in existing industries. This point of view is undoubtedly true. It is equally clear, however, that with the birth of each of these new industries we have capitalized on the advancement of science and engineering at that moment. We were able to launch the new ventures with improved automatic machinery and methods which required less human labor than the same task would have required a decade earlier. So even granting the force of argument on this point, we are gradually reaching stages of diminishing human labor requirements. My contention is that we are far from an over-production which should alarm us. At the moment there are too many countries where civilization does not even approximate the standard of living existing in the United States, and there are too many parts of our own country—particularly the rural sections—where the conveniences of city life have not been installed for us to be in danger of an immediate oversupply of labor. In fact, I feel very strongly that in a few years we will be again in a period of very strenuous production when there may be an actual shortage of human labor in this country. The urgent problem, as I see it, is not the immediate one of the next few years, but the long-time planning. The curve of human labor is downward and the curve of leisure hours is upward over the long-time projection. The pressing danger is that we will go into another period of intense production, and trained minds will again bury themselves in the tasks of the moment and fail to formulate a long-time program designed to adjust human beings to a decreasing employment curve.

The hope for this problem lies almost entirely with the educational institutions of our country. It requires a different program to adjust a man to greater leisure than it does to prepare him for intense productive activity. In fact I am one of those who believe that the task weighing down upon educational institutions in the next few decades is one of the greatest that has ever fallen on a social institution. Statistics are already bearing out this point. It is reported that institutions of secondary and higher learning will double in enrollment within the next five years. The physical absorption of these students is not so important as the fact that one reason why institutions are called upon to absorb them is due to a change in social life which requires a different educational program. It is to this phase of the problem that scientifically trained minds must give attention.

It would be unfair to hold before the ever-increasing group of boys and girls in high schools and colleges the spectre of fewer opportunities. We may as well confess, however, that this fear prevails in the minds of many youngsters today who are seriously wondering what opportunities will exist for them to make a living when they have completed their training courses. I throw out this ray of hope as gleaned from my business experience—although it is equally true in other fields. Business men are gradually changing their view toward assignments in industry. The history of the past has been that men climbed

from the ranks through to the higher positions. It was their practical knowledge that offered the best chances for promotion. This situation has changed in recent years and industry is now looking for the individuals who have been trained in the technique of research, and a multitude of assignments which previously were given to the practical men are now made purely research problems and are approached by minds trained to think their way through without the requirement of actually knowing how to do the job. The planning and thinking crews are very rapidly dominating business. Even the jobs of foreman are now going to men who can take the assignment as a research problem. So sure am I of this that to me the problem is no longer a lack of opportunity for trained minds so much as it is the ability of a business institution to absorb the fruits of trained endeavor as rapidly as they can be produced. It is my conviction that it is the untrained mind that will be forced to battle hardest to hold its position in the coming decade. The opportunities parallel the installation of more intricate machinery and methods. Trained minds are required to cope with the problems of these more intricate machines and methods—to conceive them, to install them, to analyze them and even to repair them when they break. Business is forced today to gain advantage by minute studies of problems which ten or twenty years ago were considered of little importance. I find myself, therefore, at variance with Pitkin's view that the opportunities are ever decreasing. At the moment we are in the process of replacing untrained minds with trained minds, and in the main by the simple process of changing our view toward the problem from that of a job to be done to that of a research problem to be solved.

Permit me to go back now and pick up a thread which has been dangling throughout this discussion. I refer to the ease with which we confuse immediate problems with long-time requirements. We lose the trend of the onward march of civilization in the clouds of sympathy and confusion which surround given situations. We are concerned at the moment with the facts that many human beings are out of work, others are discouraged and still others do not know any better than to kill one another through war with the tools civilization has given them primarily for other purposes. Too many forget the very obvious truth that people have used the tools of every civilization to kill one another and will continue to do so until education can teach them other approaches to their problem—or until the horrors of war and destruction become so ghastly that they will fall of their own weight. They also forget that it is not the freedom from work that concerns the unemployed. It is the inability to secure their desires which they can explain only—and logically so—by their failure to get work. One look at the whole program of doles which exists today around the world should suffice to prove that people are not averse to unemployment. The most dangerous thing on our horizon is the ease with which so many people not only accept unemployment but drift into intellectual inactivity as well. I spent a good many years close to trade unions and it is clearly evident to me that the tenacity with which organized labor fights the installation of labor-saving machinery has no relation to its long-time program for shortening Labor's periods of productive efforts. Unions know that

scientific advancement is fighting their battle for them and the only protection they can see for their members is "less hours—the same pay." Just so with organized society. It wants more unemployment and the problem is how to pay for it and how to use it. This is the long-time assignment which scientific research must open as an active experiment, and all I see ahead is a breathing spell during which we shall determine whether the scientific approach can set up machinery to solve long-time problems with the efficiency displayed in handling immediate ones.

Now lastly—to leave the problem here would be very unsatisfactory to me. I mentioned earlier that we are face to face with the paramount demands of human motives and desires—and I cherish this chance to present the view of an individualist and point out that the entire machinery of human-made institutions must key in with the desires of human beings to dominate their own world—be that limited or large. In my mind you cannot erase from the human being the desire to have a little kingdom of his own. Failure to recognize this in our long-time program will lead us to ever-recurring periods of human revolt. I express this view with a realization that much of our present activity and thinking belies such a viewpoint. My purpose in emphasizing it here is to point out that research in the realm of human beings requires a different approach than is applied to mechanical development.

One of the outstanding results of scientific activity has been specialization. Preparing this discussion has been most enlightening to me because it has brought home with force the fact that every human institution has locked step in its use of specialization. It is a direct contribution of our determination for machine efficiency—to accomplish things with the least possible effort either human or mechanical. The spirit has completely dominated our educational program. The great game of even the trained minds is to classify their fellow beings—each reserving unto himself the distinction of being in the upper brackets. Here—to me—is the crux of the whole unbalanced social problem—the cause of the cross-currents that are lashing away at the foundations of our democratic experiment. It is here that we find the fallacy that has kept trained minds out of certain fields because of the fear of classification. Educators have patterned their training program after this mechanized conception of life which was developed to fit parts of inanimate machines into smooth-running instruments. It gave birth to the inconsistency of criticizing the concentration of wealth and power on the one hand, and carrying on the same program in the realm of education with the other. I contend that here lies the cause for revolt in the human mind regardless of whether you are dealing with nationalism, class distinction or classification for physical or mental jobs. Placing control and dominance in the hands of a few on any basis—armies—wealth—politics—or education, even if paternal—will never erase the feeling of slaves from the minds of those who are forced to serve. Veblen caught this in his "Higher Learning" when he described "the esoteric group which thought it held all the secrets of life."

Inasmuch as I am out in deep water entirely too hazardous for so poor a swimmer, I am going to be foolhardy and strike for the farther shore. Basing

my decision on the conviction that the human being is paramount and that there are resources in his makeup completely untapped by our specialized and classified programs, I contend that we know very little about the distances which individuals or society—as a unit—can go in productivity and enjoyment if we call forth these hidden reserves. Certainly, I cannot draw these conclusions from a background of experience in educational fields. I can but reflect the educational requirements involved in building a smooth-running unit in business and the distances I have seen the rejected elements of our present educational program go when effective, sympathetic teacher leadership was assigned. I think I grasp—vaguely at least—the significance of the "I. Q." measurement of the race, but it is a very dangerous instrument. Certainly there are differences in human beings but each one spans a gamut of wide range—rising to high brackets at certain points of interests and sinking to unbelievable depths at others. So we find many brilliant minds descending to ludicrous lapses of judgment and morons uttering common sense. All I am pointing out is that the social problem calls for a very careful study in *blending* and our incessant attempts to classify minds is applying a scientific principle very easily misused. Our present educational program in essence is a weeding out process so designed. It is worth while to give some thought to evolving a program that will see how far we can carry each individual and at how many points of interest we can break him through into the upper brackets—rather than how soon we can slough him off.

So in conclusion may we ask individuals in science to open a new research problem in an effort to blend human beings together rather than means to pull them apart by classification and specialization as though they were elements in a test tube. We must turn the interests of capable research minds to these more evasive fields of scientific research and attempt to determine the motives that direct human beings. I am tempted even to chide the trained mind a little for the ease with which it turns its research ability into pure theoretical thinking and laboratory delving for determinable facts. I will, perhaps, be labeled a fool when I say that these fields represent the least difficult thinking. Fool then, I am, for granted a premise—theoretical projection of that premise is the most undisturbed type of thinking. Equally true—granted an assignment in pure science—it is very simple thinking if the investigator is not concerned with the obstacles of time, manufacturing, delivery or consumer acceptance. If you do not agree with this ask the men and women who have gone into industrial laboratories where these obstacles slap back at every turn.

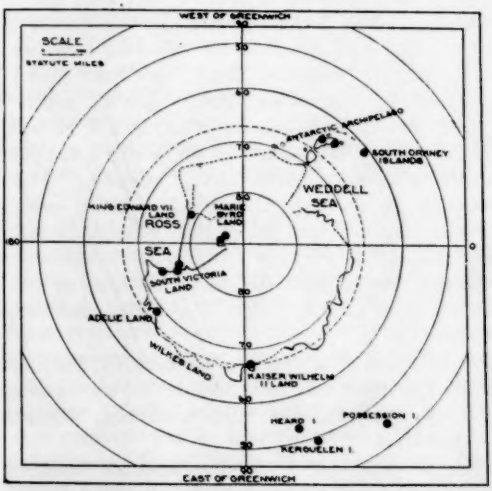
We are in our present dilemma because too few minds familiar with the technique of research and capable of analyzing the problem have undertaken the more difficult and evasive assignments. It is not a holiday for science we need so much—as a wider application of scientific investigation directed toward the problems created by the human equation. It is childish to criticize trained minds for their accomplishments for these by and large have tremendously improved the enjoyment of mankind. We can only plea for a recognition of the human being as the focal point of all endeavor and ask that assignments be opened to study his interests and desires in relation to the material advancements which have been accomplished.

# NOTES ON ANTARCTIC GEOLOGY AND PETROGRAPHY*

DUNCAN STEWART, JR.
Carleton College

In the year 1840, Charles Wilkes, in command of a United States Exploring Expedition, gave the name "Antarctic Continent" to the stretch of coast line which skirted through sixty degrees of longitude (100°-160° E.) since known as Wilkes Land. This Continent is estimated to have an area of 4,500,000 square miles the greater part of which is covered by an ice cap. Expeditions to the Antarctic have sailed from the United States, England, Scotland, France, Germany, Belgium, Norway, Sweden, Australia, and Japan, and many rock specimens have been obtained from the mainland and the outlying islands.

Two hundred and ninety-four rock and mineral specimens collected by eight of these Antarctic expeditions are to be found in the University of Michigan collections. Dr. Laurence M. Gould, geologist of the Byrd Antarctic Expedi-




Sketch map of Antarctica showing the distribution of rock specimens in the University of Michigan collections.

tion (1928-30) collected 103 of these specimens in South Victoria, Marie Byrd, and King Edward VII Lands. The remainder represents duplicate material collected by the National Antarctic, British Antarctic (*Terra Nova*), Australasian Antarctic, Scottish Antractic (1902-04), German South Polar (1901-03), French Antarctic (1903-05), and Swedish Antarctic Expeditions

* Lecture delivered before the Sigma Xi Club of Carleton College, January 18, 1934.

obtained in exchange by the University. Of the 178 specimens studied 152 thin sections have been examined qualitatively. Ninety-four sections have had their mineral constituents determined quantitatively by means of the improved Wentworth recording micrometer. Professors William H. Hobbs and Walter F. Hunt supervised the research. Fifteen chemical analyses have been added to the 158 previously recorded analyses of rocks from the Antarctic Continent and the Antarctic Archipelago.

The Gould collection consists of rock and mineral specimens from the Queen Maud Mountains of South Victoria and Marie Byrd Lands, and from the Rockefeller Mountains, King Edward VII Land (fig. 1). Eighteen duplicate specimens collected *in situ* from the Beacon Sandstone formation by the National Antarctic Expedition in the Ferrar Glacier district, South Victoria Land, and twelve duplicate rock specimens, mainly Beacon Sandstone erratics, obtained in the majority of cases from the Priestley Glacier Moraine, Terra Nova Bay district, gathered by the British Antarctic (*Terra Nova*) Expedition have been examined petrographically. There are in the collections a specimen of kenyte and an anorthoclase crystal from Ross Island, South Victoria Land. Twelve duplicate specimens of metamorphic rocks collected in Adelie Land by the Australasian Antarctic Expedition have been studied. The fifteen specimens of duplicate basaltic rocks collected by the Deutsche Südpolar Expedition in the African Quadrant are from the following localities: Kaiser Wilhelm II Land (Gaussberg), Kerguelen, Heard, and Possession Islands. In the collections are sixteen duplicate rocks, mainly igneous, which were gathered from Graham Land, Hoseason, Hovgaard, Wandell, and Wiencke Islands, and an island in the Argentina Archipelago in the western area of the Antarctic Archipelago by the Expédition Antarctique Française. The 107 duplicate specimens collected by the Swedish Antarctic Expedition were gathered from Cockburn, Snow-Hill, Seymour, and James Ross Islands, Crown Prince Gustav Canal, and Hope Bay, Louis Philippe Land in the northeastern area of the Antarctic Archipelago. Seven duplicate pieces, collected by the Scottish Antarctic Expedition are from Laurie, Saddle, Coronation, and Graptolite Islands, South Orkney Islands.

On the basis of mountain structure, age, petrography, and chemical composition of the rocks the Continent may be divided into West Antarctica, the region to the south of South America, and East Antarctica, which constitutes the remainder of the land mass.

East Antarctica is underlain by a pre-Cambrian basement complex of igneous and metamorphic rocks upon which in certain localities have been deposited paleozoic sediments. These sediments were intruded in late mesozoic or early tertiary by diabase sills of great thickness. During tertiary and recent times extrusions took place, as in the Ross Archipelago and at the Gaussberg.

The igneous rocks of South Victoria Land vary from pre-Cambrian intrusives to recent extrusives. Extrusives in the Ross Archipelago include palagonite tuffs, limburgites, kenytes, trachytes, and phonolites. The intrusives of the Mount Fridtjof Nansen district, Queen Maud Mountains, include leuco-

granite, pegmatite, granodiorite, tonalite, gabbro, melabasalt, and diabase. Various gneisses, schists, quartzites, and marbles are represented in the basement rocks. Gould collected seven specimens of biotite to biotite-hornblende schists from Supporting Party Mountain, Queen Maud Mountains, Marie Byrd Land.

Cambrian limestone breccia containing *Archiocyathinæ* has been reported in the form of erratics from South Victoria Land and from dredgings in the Weddell Sea. A formation of probable lower Paleozoic age is the slate graywacke series of Robertson Bay.

In South Victoria Land, the Queen Maud Mountains extend from Beardmore Glacier, in approximately latitude 84° S., longitude 172° E., eastward into Marie Byrd Land to at least 140° W., and form the southern boundary of the Ross Shelf Ice. These block-fault mountains, in South Victoria Land, are composed of a thick series (2,000-5,000 feet) of practically horizontal sedimentary strata with diabase sills, known as the Beacon Sandstone formation which ranges from Upper Devonian to possibly Triassic age, and which rests upon the pre-Cambrian basement.

The rocks of the Beacon formation vary from shaly types to sandstones containing approximately 99 percent quartz—from arkoses with an average of 45 percent feldspar to conglomerates containing pebbles of chert, volcanic material, diabase (?), and mica schist. The lower members of the formation contain Upper Devonian fish plates, and in the upper beds are found wood fragments, seams of low grade coal, and fossil plants belonging to the *Glossopteris* flora. The widespread occurrence of cross-bedding and the presence of coal seams indicate a continental origin of a great part of the series. The upper strata are probably Permo-Carboniferous, with deposits of Triassic (?) at the top.

The derivation of the material of the Beacon formation rocks varied, as did the conditions under which deposition took place. The presence of garnet in practically all of the Mount Fridtjof Nansen (Queen Maud Mountains) arkoses is an indication that the derivation of the minerals of the sedimentary series was probably from metamorphic rocks, and considering the general mineral content the metamorphic series was acid in character—possibly, intruded by igneous types. The presence of such minerals as microperthite and microcline in the specimens collected by the *Terra Nova* Expedition suggests that the source of this material was in granitic rocks. Volcanic fragments, mica schist, chert, and diabase (?) pebbles point to sources varying somewhat from those of the Mount Fridtjof Nansen series collected by Gould. It is possible that the sandstones of the Ferrar Glacier region represent a northern phase of the Queen Maud sediments in that the feldspar content became less as the material was carried farther from the source. Highly feldspathic sandstones have been described from the area of the East Fork of Ferrar Glacier, and they possibly represent a transition toward the typical arkoses of the Queen Maud Mountains. It is suggested that the source of the material for the arkoses of the Mount Fridtjof Nansen district was in an area to the south of this region. Undoubtedly, the source would have been in close proximity

to the location of deposition, and considering the fact that the British found quite similar arkoses in the Beardmore Glacier district it is possible that the sediments were derived from a land mass to the south made up of acid metamorphic and igneous rocks.

One of the outstanding questions of Antarctic geology and petrography is whether the rocks of King Edward VII Land are similar to those of East or West Antarctica. Late in the year 1911, Prestrud, a member of Roald Amundsen's South Pole Expedition, led a sledging party into King Edward VII Land, and collected specimens of acid intrusive rocks, gneisses, and amphibolite at Scott's Nunatak, north of the Rockefeller Mountains. Six weeks later, the members of Shirase's Japanese Antarctic Expedition (1911-12) made a collection of rocks at Scott's Nunatak. Gould, in March of 1929, made a geological reconnaissance of the low-lying peaks and ridges of the Rockefeller Mountains. These mountains are composed of monzogranite intruded by coarsely crystalline acid dikes, and cut by veins of quartz. Comparative studies by different petrographers have been made of Prestrud's specimens from King Edward VII Land, and rocks from the Antarctic Archipelago and South Victoria Land. After comparative petrographical studies of Gould's specimens from King Edward VII Land with specimens from the Queen Maud Mountains of South Victoria Land and with rocks collected in the Antarctic Archipelago by the Expédition Antarctique Française, it is concluded that the rocks of the Rockefeller Mountains have close affinities with high sodium- and potassium-bearing rocks of East Antarctica, and show little affinity with the high calcium-, magnesium-, and iron-bearing rocks of the Andes of South America and the Antarctic Archipelago.

The general structure of East Antarctica is in direct contrast to that of West Antarctica, where folding has occurred in late geological times. The Antarctic Archipelago exhibits plutonic basement rocks that are comparable to Andean types, both chemically and petrographically. In the main they are granites through gabbros, and extrusives of andesitic composition are of common occurrence. Associated with these igneous rocks are mudstones and grits. Fossiliferous strata of Mesozoic and Cenozoic ages are noted on some of the islands in the northeastern section of the Archipelago. Jurassic flora, and Cretaceous and Tertiary fauna are noted in the beds.

The striking homology between southernmost South America and the Antarctic Archipelago has been often noted: (1) the outlines and orography of the two regions are similar, (2) the geological structure is symmetrical, (3) the plutonic rocks are practically the same, (4) the sequence of Upper Cretaceous and Tertiary marine strata are the same in Patagonia and the Archipelago, and (5) the submergence and upheaval of land have befallen the two regions simultaneously. Geological evidence, chemical and petrographical studies of the rocks, and soundings off the islands point to the fact that there is a connecting link between the southern tip of South America and the Antarctic Archipelago through the Falkland Islands, South George, the South Sndwich Islands, the South Orkney Islands, the Powell group, and the South Shetland Islands.

# SOME FUNDAMENTAL PRINCIPLES IN RESEARCH TECHNIQUE

LEUNIS VAN ES
University of Nebraska

In view of the multitude of fields in which problems for research may arise, it seems obvious that, pertaining to the subject of technique, it would be impossible for any one person to define accurately definite principles applicable to all such problems. Hence, this discussion must remain limited to certain fundamentals worthy of consideration, especially by the younger workers still at the threshold of a research career.

An additional difficulty is supplied by the manifold interpretations to which the term "research" is subjected. We need not dwell on the great assortment of activities which are provided with a "research" label, but offer for the purpose of this discussion the following definition: Research is any systematic, logical, persistent inquiry in order that the truth of the matter in hand may be firmly established.

As such, research constitutes an important source of knowledge and as all knowledge must be regarded as useful, one may conclude that all research, likewise, is of value to mankind. This may be true, but mere usefulness differs greatly in degree and possibility of application.

The research worker, and especially the one pursuing his labors in institutions maintained by public funds, cannot well lose sight of this aspect of his place in society. He must deal with problems, the solution of which must bear fruit, either positive or negative, within a space of time not so far removed from the present as to lie beyond contemporary needs or even expectations.

In a measure we can approve of science for science's sake, of efforts resulting in nothing more than an increment of knowledge. However, there must be an ulterior objective tending toward the good of mankind, its intellectual and moral advancement, as well as its material well being. Thus, there rests upon workers in research a serious obligation and responsibility which cannot readily be disregarded. Although somewhat aside from the subject of this discussion, it may be appropriate to mention some of the attributes and qualifications upon which the discharge of these obligations may depend or which may help to determine the value of a worker's contributions to knowledge.

Like among humans in general, the qualities which bring competence in the successful completion of a task may either be acquired or congenital, factors which usually influence one another reciprocally. Among the acquired attributes we may count enlightened schooling, the sort of education which trains in thinking, in analyzing things observed, a training more designed to promote digestion than the mere swallowing and storing of facts. Such a training need not always be technical or professional and should not neglect the qualities which define a really educated person. It should, of course, include the fundamentals upon which a definite career can be erected.

However, training and preparation alone do not complete the mental or psychic equipment of the ideal scientific investigator. Qualities based upon a congenital "anlage" are also quite essential, or, to say the least, highly desirable. As compelling forces among them, we recognize a dominant love for knowledge and a keen interest in whatever field may be the one of choice. Thus endowed, a research worker may gather fame, but no one should enter the research field for the predetermined purpose of reaping renown. It offers no enduring place for those who are greedy for the mere charms of the limelight.

To allow one's natural vanity to transcend the boundaries of good judgment and sound ethical conceptions is apt to lead to a sort of charlatanism which may well be avoided. No doubt, various types of mountebanks have occasionally and pseudo-gloriously maintained themselves for a time as research workers but, on the whole, such individuals have left but little behind them in the nature of substantial contributions to mankind's store of knowledge. Indeed the power of restraint, which accounts for so much that is noble in human nature, also has its place in the mental makeup of the investigator.

The research worker must have a good constructive imagination as well as a keen capacity for analysis. His logic must be sound, his power for concentration intact, while a most scrupulous honesty must be his guiding principle. He must acquire the habit of persistent, critical and unbiased inquiry, coupled with an enduring patience and an untiring industry. He must have discernment so as to be able to distinguish between a real problem and merely an apparent one and with this we come to the more concrete phases of the subject to be considered.

Most frequently, problems for research automatically present themselves, and more particularly so to workers having a wide acquaintance of their fields, of its advancing margins and, above all, of its imperfections. In other instances, problems arise more or less abruptly in all lines of endeavor and are presented by interests primarily confronted by them.

The scientist rarely has to go shopping for a problem to "work on." This is more common among graduate students who, as a detail of their training, must find a subject for research, either as a means to develop their skill and logic, or in order to demonstrate capacity for independent investigational work.

In the case of the latter, the worker is not ordinarily faced by a paucity of problems awaiting solution, but by the difficulty of selecting one which can be brought to a more or less definite conclusion within a limited space of time available for the purpose, and the technical and financial means at his disposal. His difficulties are, however, somewhat compensated for by the fact that his efforts are less concerned with bringing an answer to some burning question than with the more personal aspects of preparing himself for a possible research career.

The position of the worker directly responsible for funds and time for research and for the initiation of investigational projects, is not a simple one. Therefore, he may well scrutinize the problems submitted to him with thoroughness before attempting investigational work expected to yield conclusive

results. This, of course, does not apply to those whose interest in research problems is a private one which can be privately financed.

Under the conditions which commonly affect a worker's responsibilities, one must give consideration to the character of the inquiry suggested or proposed before proceeding. Sometimes a problem is presented which was already solved by earlier workers in such a manner as to preclude the need of repetition. Or, one may be requested to undertake investigations at a time when several institutions have already been engaged in it for several years.

A further point to be considered is associated with the question: is the solution of the problem presented possible with means and methods now available or is the importance of its solution commensurate with expenditures in time and money. Stated in another way, the feasibility and justification of an investigational project should always be seriously challenged and its probable or even possible outcome and consequences carefully weighed. It is, of course, never possible to foretell, with any degree of accuracy, what results may be expected or what difficulties may be encountered in the pursuit of a project; yet to accept a research problem more or less blindly may lead to regrets and waste of funds and time.

Once a project in research is undertaken, the bibliography pertaining to the subject to be investigated or to one closely related to it, should, if at all possible, be carefully and critically analyzed. After all, the library constitutes an investigator's most valuable tool. The more final planning of the investigational strategy may well be delayed until the problem in hand has been fully surveyed in this manner.

The great diversity in the nature of problems obviously precludes the establishment of anything like rules for approach or procedure, while in addition, the latter must remain in the hands of the responsible worker. There is no more sense in prescribing his methods than there is in instructing an artist how to execute his work. In both, a very personal element must be accepted as dominant.

Research problems may be relatively simple or highly complex. The question to which an answer is sought may be answerable by a mere affirmative or negation or may require a more or less elaborate exposure of facts established. In either case, there may be virtue in reducing the problem to the simplest question possible and to keep this question in mind as the guiding lodestone in investigational pursuits.

The adherence to this principle may help the investigator to avoid many of the non-essential subsidiary problems which he may meet in this progress. On occasion, it may prevent the main line of investigation from ingloriously terminating in a *cul-de-sac*.

Deliberately or unconsciously most workers will face their problems with a more or less well-defined hypothesis and this may even be imperative in the logical designing of the investigational technique. In research the hypothesis is somewhat analogous to the scaffold used in the building trades. It is a temporary structure and, constituting a mere means to an end, it should never be looked upon as the fact to be proved.

An investigator may become enamored with his hypothesis, obsessed by it as a product of his own creative imagination and cherished like the apple of his eye. When a hypothesis thus becomes sacred, it likewise becomes dangerous. Therefore its flaws and faults should be diligently searched for, first mentally and then tactically. In nothing should a worker be more concerned than in proving that the hypothesis is wrong. By the time his failure to do so becomes apparent, the solution of his problem may not be far off.

When a research project is once launched, there must be definiteness of purpose and methods carefully chosen must find application. A program, plastic, flexible and yet rigidly directed toward finding an answer to the question involved must be followed. Flexibility in technique must, however, be preserved because in but few projects is it possible to foretell with distinctness and detail the obstacles which are apt to be encountered or even the amount of time required before they can be overcome and the project be advanced to its final phases.

The methods employed must be designed to avoid error in conclusion. Although a certain degree of speculation may be more or less admissible, the aim of the worker should be to reach his objective without depending on it and to solve his problem by carefully planned experimental inquiry. In all this, multiplicity of observations has its place. This applies particularly to investigations in the biologic field owing to the many uncontrollable factors associated with living nature. Conclusions based upon an insufficient number of observations often are vitiated by the variability of the material, the relatively large factor of error and possibly by too small a number of biologic entities used in the experiments.

In biologic research, above all, success is, to a large extent, dependent upon the skillful use of control experiments and it has been said, with a considerable display of truth, that the thoughtful placing of controls constitutes the most important detail of investigational tactics. In no other instance was the genius of Pasteur more brilliantly displayed than in the placing of his control animals in the classic researches which led to the preventive treatment of rabies. Ruthlessly assaulted by the medical standpatters of his day, these controls blocked every avenue for attack or doubt. They formed the impassable barrier against the malicious attacks of which the Master had been continuously exposed and for once and all times settled the question whether or not the truth can be revealed by purely experimental inquiry.

It is scarcely necessary to emphasize the need of a careful and accurate recording of all data obtained in an investigation. Nothing should be left to memory, because some of the most important facts to be ascertained may also turn out to be the most elusive ones and also because the time required for the completion of a project may be unexpectedly prolonged. The method of recording may be determined by the nature of the investigation as well as by the individual choice of the worker. The principal specification for recording is that all methods employed, all data obtained, all observations made, be accurately set down in chronological order and that this be done in such a manner that no future doubt can arise from faulty chirography or diction.

In all research efforts, accuracy is always more important than speed in achievement and one should never be disturbed by the prospect of some other worker publishing his results first. After all, a research worker is not a marathon performer and the priority chaser does not particularly enhance the dignity, beauty and usefulness of the sciences. Hence, at the conclusion of a project, and even after all data have been weighed, there may be advantage in scrutinizing the results and to ponder about their significance, in order that the facts may be correlated and the logic of tentative conclusions challenged.

In a certain proportion of research projects, it may be essential to pursue some of the subsidiary problems which presented themselves in the course of the work done toward finding the answer to the question primarily posed. The final report of the work may be rendered more valuable by such complementary efforts.

The ultimate results of an investigation can never be predicted with any degree of precision. They may be entirely negative and yet have a manifest value. The latter is dependent on the experimental technique, its conception and its execution. If this is flawless, if the quality of work is such that it need not be repeated, or that a concrete problem is definitely solved by it, its author should not be discouraged and should not hesitate to publish his results. Negative evidence may indeed have a decidedly positive importance.

Of course, the results of research should always be published, if they are to be of value at all. It is not always advisable that this should be delayed until the conclusion of the entire project. This is especially the case when more complex problems, with different and distinct phases, are the subject of research efforts. It may also apply to investigations which bring to light more or less uniform sub-problems, which must be dealt with before the solution of the primary problem can be advanced.

A distinction should always be made between publication and publicity. Undue publicity pertaining to research work may bring about a sort of charlatanism which can only result in injury to the cause of scientific investigation. When a research worker undertakes directly or indirectly to proclaim his achievements and virtues in the public press, he, perhaps unconscientiously, enters the field of the mountebank, not only endangering the general confidence enjoyed by his institution, but also compromising the workers who labor at his side.

The above statement does not by any means indicate that a general public should not share in the acquisition of new knowledge resulting from efforts in research. The information thus obtained may well come to the ephemeral press, if such should be desired, in a more indirect manner, preferably by means of abstracts from the primary publications in public reports, bulletins and scientific journals. This seems all the more proper in order that a given result may be first received, digested, or even criticized by other workers competent to judge its merits. The quality of the work may thus be tested to a degree and thus the author himself may profit by criticisms for the good of the cause he serves.

Authors with results to publish have an ample choice among the journals devoted to their fields and the publications sponsored by their particular institutions. Workers, as a rule, will prefer to publish their work in their own way and in this they should not be restricted. Certain desirable qualities of research publications may, however, be pointed out.

They should, if possible, be made to include reference to what has already been contributed by other workers. They should contain a clear statement or tabulation of the data upon which conclusions are based and the method by which the data were obtained. The subject matter should be so stated and arranged that a reviewer will have no difficulty to thoroughly understand the methods employed and the logic applied by the author. Irrelevant and immaterial discussions may well be omitted and the publication, as a whole, should always be worth while and actually constitute a contribution to knowledge.

This presentation of certain general aspects and principles of research cannot be accepted as a complete exposé of the philosophy underlying investigational attempts. The subject may even be inexhaustible. We merely hope to convey the impression, and especially to those who eventually will labor in the field of scientific investigation, certain phases of research work worthy of their consideration and to encourage them to regard their functions only in the light of a search for truth. The worker in research must always remain conscious that he labors for the benefit of his fellow man and for the advance of our civilization. As such he has responsibilities, the honest discharge of which can only be regarded as a sacred duty.

# MINUTES OF THE MEETING OF THE EXECUTIVE COMMITTEE OF SIGMA XI

## Washington, April 24, 1935

The first meeting of the Executive Committee for 1935 was held at the Cosmos Club, Washington, D. C., April 24, 1935. The meeting was called to order at 2.00 P.M. by President Parker. Retiring President Wilson, Secretary Ellery, Treasurer Pegram, Professor True, Prof. H. V. Wilson, Professor Stadler, Professor Miller, Doctor Utley, and by invitation during a part of the deliberations, Prof. Henry B. Ward, Secretary of the A. A. A. S., and past president of Sigma Xi; Prof. C. E. McClung, past president of Sigma Xi; Dean Richtmyer, past president of Sigma Xi; and Mr. Davies, past chairman of the Alumni Committee, were present.

Business was transacted as follows:

1. FORMAL PETITION FOR A CHARTER FOR A CHAPTER:

Following the action of the Committee at the December meeting, the Secretary presented a formal printed petition for a charter for a chapter at Carleton College. It was

*Voted*—a. To distribute the petition among the chapters sometime prior to the next national convention; and

b. To present the petition to the convention with recommendation for favorable action.

2. INFORMAL PETITIONS FOR CHARTERS FOR CHAPTERS:

a. University of Buffalo.

b. University of Florida.

At the December (1934) meeting of the Committee, following action at a prior meeting, the Secretary presented the report of the official visitor to the University of Buffalo, Prof. T. R. Wilkins of the University of Rochester; and of the official visitor to the University of Florida, Prof. J. K. Roberts of the University of Virginia. Action on the reports and the petition from the University of Buffalo was made a special order of business for the spring meeting of the Committee. Action on the petition from the University of Florida was postponed pending the receipt of information regarding the relation of the Experiment Station at Gainesville and the University, and of report from a visit to the University to be made by Dr. L. B. Wilson. After full discussion of the reports and of the conditions at these institutions, it was

*Voted*—a. To request the group of petitioners at the University of Buffalo to present a formal printed petition for a charter for a chapter for consideration of the Committee at some later date;

b. To inform the petitioners at the University of Florida that Sigma Xi could for the present best function at the University through the continued activities of the Sigma Xi Club now in existence at the Institution.

3. PRELIMINARY INQUIRIES:

I. a. Wayne University.
b. Oregon State College.
c. Virginia Polytechnic Institute.

Detailed information about these institutions had been under study by the members of the Committee since the December meeting, and was discussed at length at this (April) meeting. It was

*Voted*—a. That conditions at Wayne University were not at present such as to justify taking any further steps in connection with a petition for a charter for a chapter;

b. That in the case of Oregon State College no action be taken at this time, and that definite information be secured regarding the amount of work in science that is being done at the University of Oregon in Eugene and the State College at Corvallis;

c. That in the case of Virginia Polytechnic Institute the National Secretary be instructed to get further information about the resources and equipment of the institution, particularly from neighboring chapters.

II. a. Carnegie Institute of Technology.
b. University of Utah.

It was

*Voted*—That the National Secretary be instructed to transmit to the members of the Committee a month before the December meeting detailed information about the resources and equipment and scientific work of these institutions.

c. University of Hawaii.

A letter was presented from Professor McClung recommending that the Committee give consideration to the scientific work done at this University and in its vicinity. The Secretary reviewed the previous study of the University made in 1931 by a special committee, of which Dean Baker (then of Syracuse University) was chairman, and reported the action taken by the Executive Committee in 1933, namely that the group of petitioners at this University be advised to organize a territorial alumni chapter with the University as its nucleus; and also that the group had not as yet taken definite steps toward the formation of such an alumni chapter. It was

*Voted*—That the action of the Executive Committee regarding the petition for a charter for a chapter at the University of Hawaii be confirmed.

4. DIPLOMAS FOR MEMBERS AND ASSOCIATES:

The Secretary reported some complaints that the stock used in the official diplomas was not suitable for engrossing of names of members and associates and institutions, and stated that heavier paper would add to the cost of the diplomas to the chapters. It was

*Voted*—That the Secretary be authorized to improve the quality of paper used in the diplomas of the Society, if such improvement could be made without too large increase in the cost to the chapters.

5. REPORT OF THE ALUMNI COMMITTEE:

At the December (1934) meeting of the Executive Committee, several important matters were referred to the Alumni Committee for study and report at the April meeting. Doctor Utley, chairman of the Alumni Committee, stated that the Committee had completed its work in this connection, and asked Mr. Davies to present the report. The report is given in full on page 80, this issue.

The Executive Committee expressed its appreciation of the work accomplished by the Alumni Committee, and

*Voted*—a. That the report be accepted and approved;

b. That a committee of three be appointed by the President to frame and present to the next convention the amendments to the National Constitution which the report recommended as desirable;

c. That this committee be asked to include in its recommendations one covering the distribution of formal petitions for charters for chapters to chapters prior to the convention at which action is expected to be taken.

President Parker appointed as such committee: Mr. Davies, Treasurer Pegram, and Secretary Ellery.

6. GRANTS-IN-AID OF RESEARCH:

The Treasurer reported that contributions to the Alumni Research Fund had been received for the current year amounting to something over $2,000, and that there was some balance in the fund from previous years. It was

*Voted*—To make available for the Committee on Award of Grants-in-aid for 1935-36 the unexpended balance of the alumni fund as of May 1, not already appropriated for use in 1934-35.

7. THE GRADE OF "ASSOCIATE":

At the December (1934) meeting of the Executive Committee a communication from the Yale Chapter was presented recommending that the Committee consider the advisability of abandoning the grade of associate in the election of undergraduates into the Society. The Committee brought the suggestion to the convention and asked for discussion.

The original recommendation and the suggestions of the convention and letters from former officers were all given full and careful consideration. (A letter on this subject from Prof. Julius Stieglitz, past president of Sigma Xi, appears on page 84.) It was

*Voted*—That in the opinion of the Executive Committee the present practice of the Society of electing undergraduates and others as associates be continued.

8. Amendment to Constitution:

At the thirty-fourth convention of the Society the Executive Committee proposed an amendment to the constitution as follows:

> The Executive Committee is empowered to elect as associates in the Society students in institutions where there is no chapter of Sigma Xi who have shown marked excellence in two or more fields of science, pure or applied, and to provide for their initiation.

Action on the proposal was deferred until the thirty-fifth convention. This convention voted to lay the proposal on the table for consideration at some future convention.

The Executive Committee reviewed the subject again at this (April) meeting, and it was

*Voted*—That the proposal that the Executive Committee be empowered to elect associates be withdrawn.

9. The Thirty-sixth Convention:

a. Possible topics for the fourteenth annual Sigma Xi lecture were suggested as follows:

Transportation
Transmutation of the Elements
Light and Sound
Genetics

b. The Secretary reported a growing lack of interest in the annual dinner of the Society, held in connection with the convention, largely due to the fact that members preferred to attend dinners given on the same evening by scientific societies with which they are connected. It was

*Voted*—That the Secretary be instructed to arrange for a joint dinner of Sigma Xi and some other scientific society holding a dinner at the same time.

10. Sigma Xi Lectures and Their Publication:

Professor Stadler proposed that Sigma Xi sponsor the publication each year of a book on some scientific subject of general interest. This book should consist of chapters or sections by a number of authorities eminent in the field covered. These contributions could be independent, but the topics should be so chosen as to form a coherent treatment of the general subject. The object would be to produce a volume of the greatest value and interest to the enlightened but non-technical public—that is to a reading public corresponding to the audience toward which the public lectures of a Sigma Xi chapter are directed.

It seems that a book of this character would be a most valuable addition to the popular science literature of the day, and that its publication would be a real public service. The Sigma Xi Society is uniquely fitted to perform this service.

Professor Stadler suggested that the project is not only decidedly worth while on its own account, but it could also be used in helping the individual chapter to present stronger programs.

The value of a chapter to its members is dependent in large part on its ability to bring in scientists of high attainment for lectures and for informal conference. The activity of most chapters in this direction is sadly limited by the expense of honoraria and travel. They therefore depend chiefly on local speakers and chance visitors, with perhaps one or two lectures each year by scientists invited specifically for the purpose. Acceptance of these occasional invitations may entail some sacrifice on the part of the lecturers invited because of the necessity of preparing public lectures for isolated occasions, the disproportionate time spent in travel, and the usually very modest honoraria.

A competent editorial board could be authorized to select each year the general subject to be treated and the lecturers to be invited. Each contributor would be expected to present his lecture before a limited number of chapters in a tour to be scheduled within a period specified by him, and also to submit an appropriate version for publication. A substantial honorarium would be paid for the lectures, and it could be provided that any royalties on the book in excess of the expenses of the plan should be divided among the authors.

The proposal was favorably commented upon by the Committee and it was

*Voted*—That the President appoint a committee of three to consider the proposal and to make recommendations at the next meeting.

11. THE BUDGET FOR 1935:

The attention of the Committee was called to the fact that during the next year and a half the Society would be under some additional expense incident to the preparation for and the celebration of the Semi-Centennial. Treasurer Pegram proposed the following budget for 1935:

| | |
|---|---|
| The Secretary's office, salaries, postage, supplies, etc. | $4,800.00 |
| Treasurer's office | 200.00 |
| Officers' traveling expenses | 1,200.00 |
| QUARTERLY | 2,200.00 |
| Engrossing charters | 100.00 |
| Total | $8,500.00 |
| Special expenses for Semi-Centennial: | |
| Additional clerical assistance | $1,200.00 |
| Miscellaneous expenses, circularization of alumni, etc. | 1,500.00 |
| | $2,700.00 |

It was

*Voted*—That the budget be approved as proposed.

12. FINANCIAL ADVISORY COMMITTEE:

The Treasurer called attention to the growth of the permanent funds of the Society and the necessity of investing them in the most favorable way, and suggested than an advisory council on investments be named. It was

*Voted*—That the President be empowered to appoint a committee of three, with terms of not more than three years, to advise the Treasurer

as to investments from time to time, and to review with the Treasurer at least once a year the investments of the Society.

13. THE SEMI-CENTENNIAL:

The Committee approved a program for the Semi-Centennial, which is given in full, page 56, this issue.

14. ADJOURNMENT:

The meeting was adjourned at 11.00 P.M.

EDWARD ELLERY, *Secretary*

## REPORT OF THE ALUMNI COMMITTEE

*To the Executive Committee of Sigma Xi:*

RECOMMENDATIONS:

Your Alumni Committee recommends

(1) That Sigma Xi Clubs at institutions be not converted into Alumni Chapters;

(2) That continuous pressure be maintained to secure annual contributions to the Alumni Fund;

(3) That a simple form of local alumni organization of Sigma Xi with a scheme of self-financing be provided on a temporary basis as outlined hereinafter;

(4) That this new alumni organization plan be launched in 1936 at the Semi-Centennial.

THE PROBLEM:

At the meeting of the Executive Committee of Sigma Xi on April 29, 1934, the request of the Sigma Xi Club at the University of Arkansas to form an Alumni Chapter was referred to the Alumni Committee to study and report. This request arose from the action of the Executive Committee at its meeting on June 21, 1933, as follows:

> "That the Secretary be directed to correspond with those clubs whose activities and interest and enthusiasm warrant the suggestion of the National Board recommending to them the possibility of forming an alumni chapter in their locality."

On May 10, 1934, Secretary Ellery wrote that "the idea in the minds of the Executive Committee at the time its action was taken was that when and if Sigma Xi Clubs presented to the Executive Committee a petition to organize an alumni chapter, the Committee would study the situation as carefully and exhaustively as it does in the case of petitions for institutional chapters. If, after such careful study, the Committee became convinced that an alumni chapter should be established with some educational institution as a nucleus, it would present the petition to the convention with recommendation for favorable action."

Publication of the June, 1933, action in the QUARTERLY brought two requests from Carleton College and the University of Arkansas. In April, 1934, Carle-

ton College was accorded an official visitor with the view to the establishment of an Institutional Chapter.

As the problem is fundamentally one of alumni organization, the Executive Committee felt that the entire matter should be explored by the Alumni Committee.

PRESENT ALUMNI ACTIVITIES:

The Constitution of Sigma Xi provides for the establishment of "An Alumni Chapter at any place where the objects of the Society would be furthered thereby. Alumni Chapters have all the rights and privileges of Institutional Chapters, except that as hereinafter provided they are limited in making elections of new members." The limitations provide that the Alumni Chapter shall not elect more than a number previously set for the Chapter by the Executive Committee. Sigma Xi has only one Alumni Chapter, the District of Columbia, with a membership of 425, of which eighty-seven are active. At the December, 1934, meeting of the Executive Committee, the District of Columbia Chapter was permitted to elect each year a number of new members not exceeding 10 percent of the dues-paying members. The alumni in Washington feel that the neighboring institutional chapters are not in a good position to judge the accomplishments of individual scientists in the employ of the government. Furthermore, the election to membership by the District of Columbia Chapter seems to give greater prestige than election by any of the neighboring institutional chapters.

Alumni organization has been carried on sporadically in other centers. In Chicago, under the leadership of Donald H. Sweet, a board of fifteen was organized. Some good meetings of alumni were held but the organization was difficult to bring together and when Mr. Sweet became occupied by other duties, the activity ceased. Exactly the same experience was had in New York under the leadership of C. E. Davies. Three or four good annual meetings were held and then the organization ceased to function. There was no formal organization in New York, only a dinner committee. In both Chicago and New York the meetings were very well received. The activity dropped when the self-appointed leaders were obliged to give attention to other matters. Despite the press of other interests in larger metropolitan committees, we are confident that under some simple scheme of organization providing continuity of leadership, opportunity for contact and discussion will be welcomed by a large number of Sigma Xi alumni.

By far the most useful activity of the alumni is the Alumni Fund. Since the start of the fund in 1921 $32,596.40 has been collected and $31,743.93 spent in research grants.

ALUMNI RESPONSIBILITY TO ADVANCE SIGMA XI OBJECTS:

The objects of Sigma Xi are stated to be "The encouragement of original investigation in science, pure and applied." The functions of the Society are:

1. Holding meetings, etc.
2. The establishment of fraternal relations among investigators in scientific centers.

3. The granting of membership.
4. Publications.
5. Support of fellowship for research.

The Institutional Chapters appear to be doing something along the line of the first four activities. The Alumni Chapters are carrying on only the latter activity, but there seems to be a splendid opportunity for further activity in objects 2 and 4, as well as 5.

LOCAL ALUMNI ORGANIZATION:

In general the membership of Sigma Xi is an aristocracy of research skill. Our members at institutions are close to the problems of research. Some of our alumni are but many have removed from research into professional or business careers. Every alumnus is proud of membership in Sigma Xi and insofar as time and resources permit would contribute gladly to the purposes of Sigma Xi. Mobilizing this enthusiasm in support of Sigma Xi purposes presents two problems, organization and finance. We shrink from too much organization merely for the sake of organization. The organization should be simple and a local secretary appointed by the President in each locality where there are fifty alumni would seem ample. For financing the modest expenses for notices of meetings, permit each alumnus who wishes to include one dollar with his contribution to the Alumni Fund and turn the dollar over to the local secretary. Additional local dues may be collected if desired. Successful functioning of a local alumni group should be a requirement for establishment of an Alumni Chapter.

THE ALUMNI FUND:

The Alumni Fund should be kept continuously before the alumni. Each should receive a yearly reminder in the form of a subscription blank which should also include opportunity to subscribe to the operating expenses of the local group. Every subscriber should receive the QUARTERLY.

The effort to establish an invested Semi-Centennial Fund will of necessity have precedence over the annual campaigns which should be reinstated after 1936.

SIGMA XI CLUBS:

All of the Sigma Xi Clubs are located at institutions of learning and research. They seem to be organizations of members preliminary to the establishment of institutional chapters. Presumably they are groups of alumni and are permitted to subscribe to the alumni fund.

The function of electing members is denied them. We agree as to the wisdom of this because the quality of our membership is highly important and should be protected as completely as possible. Election to membership should therefore be limited to institutional chapters at institutions doing adequate research and alumni chapters outside of institutions. The clubs being organized at institutions should not be permitted to elect members under the subterfuge of organizing them as alumni chapters. If there is no chance of being accepted as an institutional chapter, the members of the club, if there are fifty, might organize a local group of alumni as provided above.

REPRESENTATION AT CONVENTION:

The constitution provides that the 15,000 alumni shall be represented at conventions by the Alumni Committee of five. This seems inadequate. Each organized alumni group should be permitted voice and vote at conventions except on new chapters and chapter assessments.

OTHER FACTORS:

Increased alumni activity will undoubtedly mean some increased expense in the Secretary's office.

Upon adoption of any suggested changes they should be recorded in a changed Constitution and By-laws.

SUMMARY:

The Alumni Committee recommends:

1. That the present scheme be retained of alumni clubs at institutions where chapters have not been established. That they be not permitted to elect members and that their status be defined in the Constitution and By-laws with the procedure for establishing new chapters, both institutional and alumni.

2. That after the Semi-Centennial Fund effort is completed, continuous opportunity to alumni to subscribe to the Alumni Fund be given. The permanent fund to celebrate the Semi-Centennial will not be participated in by all alumni and continuous contact should be maintained with every alumnus through the QUARTERLY.

3. That the following scheme of local alumni organization be authorized in a limited number of alumni centers for a period of not to exceed three years. At the end of that time decision is to be made as to continuance or modification.

(a) The President is authorized to appoint (and dismiss) a local secretary, authorized to call meetings of local groups of alumni. Subsequent organization and program making to be in the hands of the local groups.

(b) Contributions to National Secretary from members in the local groups will be returned to the local secretary, or

(c) Local groups may collect local dues.

(d) The formation and successful conduct of a local alumni group shall be a prerequisite to the granting of a charter for an alumni chapter.

(e) Each alumni group that meets minimum conditions to be prescribed, shall be permitted voice and vote at conventions except on granting new charters for chapters and on levying chapter assessments.

4. That the new scheme of alumni organization be not put into effect until 1936.

FREDERICK B. UTLEY, *Chairman*,
HENRY G. KNIGHT,
DONALD H. SWEET,
HAROLD F. NORTON,
C. E. DAVIES.

# THE ASSOCIATE GRADE

JULIUS STIEGLITZ

In the March number of the SIGMA XI QUARTERLY I note the resolution submitted by the Yale Chapter to eliminate the Associate Grade and open the way again for the election of undergraduates to full membership in the Society in all chapters.

As President of the Society during the years when the revision of the constitution providing for associate membership was under active consideration, may I state briefly the position of the Society at the time the change was made:

1. The Society decided that the mere promise of research ability on the evidence of good standing in two departments was no longer sufficient for election to full membership in a Society devoted to *Zealous Research*, under the changed conditions by which the opportunities for actual accomplishment in research had been shifted from the colleges to the graduate schools. The great increase in the number of these schools and in their facilities and actual output of research is a matter of history. Distinction in two fields may be a sound basis for gauging the ability of a student, but it is not a measure of his research power, or even of his inclination to, and love for, original work. The impressive increase in research productivity in the graduate departments made possible a very simple and straightforward basis of qualification for membership in a research society by demanding creditable performance of actual research as a requirement for full membership.

2. The Associate Membership was devised in order to make it still possible for *promising* undergraduates (seniors) and worthy graduate students, to get the benefit and stimulus of attendance at meetings and of the mingling with mature workers. Election to Associate Membership is highly prized here by our undergraduates. It is listed in our Convocation programs together with election to Phi Beta Kappa and to full membership in Sigma Xi.

3. The inauguration of the Associate Membership opened the way for broadening greatly the influence of the Society by making possible the granting of petitions for new chapters in many schools, by the new safeguards established for election to full membership. The extraordinary growth of the Society since 1922 is evidence of the wisdom of the step. The new keynote of research accomplishment versus undergraduate promise, our insistence on a high level of accomplishment for full membership, must have been of great weight in the establishment of chapters in such great centers of research as McGill, Johns Hopkins, California Institute of Technology, Harvard, Princeton, Massachusetts Institute of Technology, etc., institutions which previously had refused to be interested in our Society.

4. Vested rights of existing chapters, like Yale, to continue to elect undergraduates, were carefully protected. It was hoped that in the course of time the reality of research as compared with the mere possibility of the development of research ability, would appeal to these older chapters and lead to their

adopting the higher level of attainment required for membership for the great majority of present members of the Society. If I interpret correctly the statement on page 38, II C, of the current QUARTERLY at the present time only six of the sixty-six chapters elect undergraduates to full membership. (Is this interpretation approximately correct?) If uniformity is to be aimed at, it would be far more worthy of the ideals of the Society that the older chapters in the exempt schools which have graduate departments voluntarily conform to the current higher level of qualification for membership. The Society, I am sure, would cordially approve the action of the original chapters *in schools of engineering* of continuing to elect members on the original basis of qualification. As a matter of fact I have found that graduates from good schools of engineering are perhaps a year more advanced in their preparation than the graduates from most colleges.

5. Many of the original thirty-five chapters (antedating 1922) voted to grant charters to schools with small graduate departments because of the protection to full membership on the basis of the higher level of attainment required. To do away, now, with this protection and to lower the level and make Sigma Xi merely an honorary undergraduate Society would seem to many of us a very serious blow at the prestige of research. In our own chapter election to full membership rarely occurs before the last quarter or two before the Doctorate is taken—that is, the research work for the degree must be essentially complete, publication insured, and research power completely proved.

Personally, I hope that our banner of *Companions in Zealous Research* will continue to represent the purpose of the Society in this great era of far-flung serious research.

## A CORRECTION

In the proceedings of the thirty-fifth convention printed in the March (1935) issue of the QUARTERLY the name of the representative of the Sigma Xi Club of the University of Florida was inadvertently omitted. The delegate of that club to the convention was Prof. George F. Weber, plant pathologist in the Agricultural Experiment Station of the University, and he was present at the entire session.

# CHAPTER OFFICERS

List Furnished by the Secretaries of the Chapters

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# OFFICIAL ANNOUNCEMENTS

## SIGMA XI EMBLEMS

All insignia of the Society are available only through the office of the National Secretary. They are made in various styles and sizes and in white and yellow gold. Orders for these insignia are issued through chapter secretaries, and must be *prepaid*. Information about styles and prices may be obtained from chapter secretaries or the National Secretary.

## DIPLOMAS FOR MEMBERS AND ASSOCIATES

These diplomas are available in any quantity at 9 cents each. Orders should be sent to the National Secretary, should specify whether for members or associates, and should be accompanied by check.

## INDEX CARDS

Index cards for newly elected members and associates are available *gratis* upon requisition from chapter secretaries to the National Secretary. These cards should be made out in duplicate, one set being retained for chapter files and one set being sent to the National Secretary for filing in the permanent records of the national organization.

## NATIONAL CONSTITUTION

Printed copies of the National Constitution, containing all amendments to date, and all recent interpretations as made by the national officers on request of chapters, are available at 9 cents each from the National Secretary.

## CHANGES OF ADDRESSES

Chapter secretaries are asked to send to the National Secretary in October of each year changes in their enrollment lists as follows: 1. Names and addresses to be deleted from the previous list; 2. Names and addresses to be added to previous list; 3. Changes of addresses of those on previous list who may have moved to a new address since the list was submitted.

EDWARD ELLERY,
*National Secretary,* Sigma Xi,
Union College,
Schenectady, N. Y.